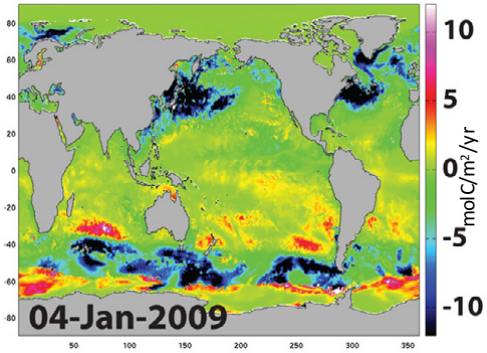
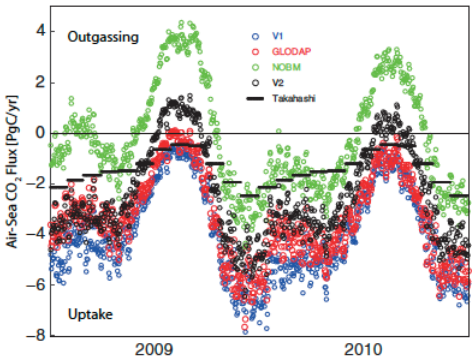
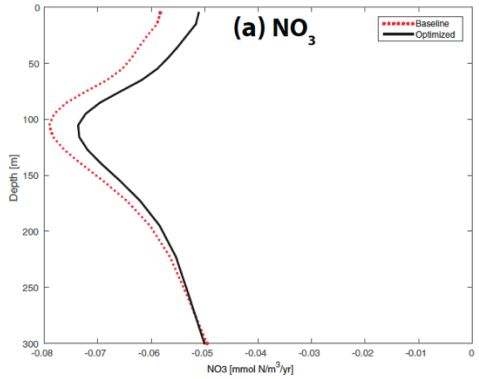
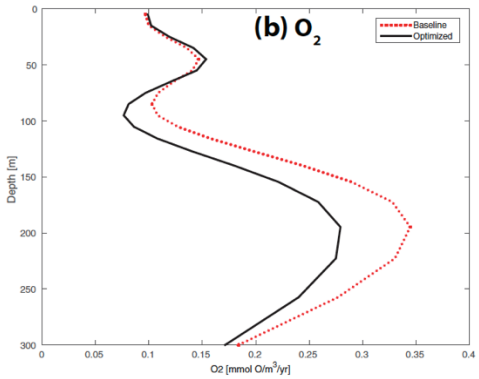
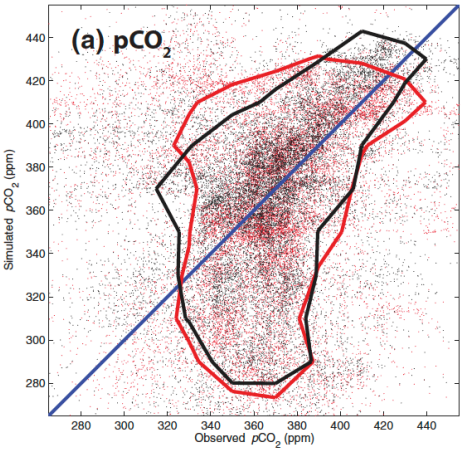
Global, Eddying, Ocean Ecology and Biogeochemistry Model

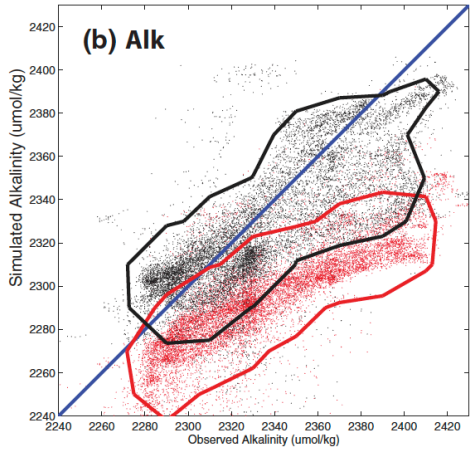












Problem: Global ocean biogeochemistry models suitable for Carbon Monitoring System (CMS) Flux studies require high spatial and temporal resolution to capture fine scale structure of carbon sources and sinks. The problem addressed here is initialization/adjustment of such a model to minimize drift and distance from observations.

Finding: The trajectory of a global, eddying ocean biogeochemistry model can be adjusted to simultaneously reduce drift and distance from observations using a Green's function approach.

Significance: The adjusted simulation is a first step towards a more accurate representation of ocean carbon cycle at high spatial and temporal resolution, suitable for studies of global air-sea-land exchanges of carbon and ocean acidification.

Top left: Example sea-air CO_2 gas flux showing impact of ocean upwelling and synoptic atmospheric variability (negative values indicate ocean uptake).

Top right: Globally integrated sea–air CO_2 fluxes for 2009 and 2010 for four different model realizations (baseline is blue circles, two model Green's functions in red and green circles, and optimized in black circles), vs Takahashi Atlas (black lines).

Middle: Global volume-weighted trend vs. depth plots for nitrate (left) and oxygen (right), for the baseline (red) and optimized (black) simulations.

Bottom: Scatter plot of observed (x-axis) and simulated (y-axis) pCO2 (left) and Alkalinity (right) for baseline (red) and optimized (black) simulations.

Publication from the CMS Bowman-01 Project

H. Brix, D. Menemenlis, C. Hill, S. Dutkiewicz, O. Jahn, D. Wang, K. Bowman, and H. Zhang, 2015: Using Green's Functions to initialize and adjust a global, eddying ocean biogeochemistry general circulation model. Ocean Model., 95, 1-14. doi:10.1016/j.ocemod.2015.07.008